

Appl. No. 10/608,391
Amdt. dated March 28, 2006
Reply to Office Action of January 6, 2006

PATENT

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings of claims in the application:

Listing of Claims:

1-31. (Canceled)

1 32. (Currently amended): A storage system coupled to a host computer via a
2 network comprising:
3 a data volume storing write data from the host computer;
4 a snapshot storing area storing a first snapshot of at least a portion of the data
5 volume for a first point in time, the first point in time represented by first information that
6 specifies a time when the first snapshot is taken, the snapshot storing area further storing a
7 second snapshot of said at least a portion of the data volume for a second point in time, the
8 second point in time represented by second information that specifies a time when the second
9 snapshot is taken;
10 a journal storing area storing journal entries, wherein the journal entries comprise
11 the write data and time ordering information specifying write ordering of write operations to the
12 data volume; and
13 a storage controller to conduct write operations according to write requests
14 received from the host computer, to manage snapshot operations to store a plurality of snapshots
15 including the first snapshot and the second snapshot, and to manage journal operations to record
16 the journal entries,
17 wherein the first and second information are associated with the time ordering
18 information to specify time ordering among a time when one of the write operations is
19 conducted, the first point in time, and the second point in time,
20 wherein when receiving a data recovery request with a target time between the
21 first point in time and the second point in time, the storage controller selects one of the first
22 snapshot or the second snapshot based on the first information, the second information and the

Appl. No. 10/608,391
Amdt. dated March 28, 2006
Reply to Office Action of January 6, 2006

PATENT

23 target time, and selects at least one of the journal entries corresponding to the write operation
24 conducted between one of the first or second point in time associated with the selected snapshot
25 and the target time based on one of the first or the second information associated with the
26 selected snapshot, the time ordering information, and the target time to recover data of said at
27 least a portion of the data volume at the target time by using the selected snapshot and said at
28 least one of the journal entries,
29 wherein the storage controller monitors the journal storing area and releases at
30 least one of the stored journal entries.

1 33. (Previously presented): The storage system of claim 32, wherein the time
2 ordering information includes time information and/or a sequence number.

1 34. (Previously presented): The storage system of claim 33, wherein the first
2 and second information include time information and/or a sequence number.

1 35. (Previously presented): The storage system of claim 32, wherein the write
2 data stored in the journal storing area are stored in chronological order.

1 36. (Previously presented): The storage system of claim 32, wherein the
2 snapshot storing area and/or the journal storing area are configured with storage volumes.

1 37. (Previously presented): The storage system of claim 32, wherein at least
2 one of the journal entries are stored in the journal storing area before storing one of the plurality
3 of snapshots in the snapshot storing area.

1 38. (Previously presented): The storage system of claim 32, wherein the
2 journal operations are started prior to starting the snapshot operations.

1 39. (Previously presented): The storage system of claim 32, wherein the
2 selected snapshot is closest in time to the target time.

Appl. No. 10/608,391
Amdt. dated March 28, 2006
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PATENT

1 40. (Previously presented): The storage system of claim 32, wherein the
2 selected snapshot is prior in time to the target time.

1 41. (Currently amended): A method for storing information on a storage
2 system coupled to a host computer via a network, the method comprising:

3 conducting a write request received from a host computer, the write operation
4 request including write data associated therewith to be stored on a data volume;

5 storing journal data corresponding to the write data to the data volume from the
6 host computer;

7 storing time ordering information specifying write ordering of the write data to
8 the data volume from the host computer;

9 storing a first snapshot of at least a portion of the data volume for a first point in
10 time, the first point in time represented by first information that specifies a time when the first
11 snapshot is taken; and

12 storing a second snapshot of [[a]] the portion of the data volume for a second
13 point in time, the second point in time represented by second information that specifies a time
14 when the second snapshot is taken;

15 wherein the first and second information are associated with the time ordering
16 information to specify time ordering among a time when the write request is conducted, the first
17 point in time, and the second point in time,

18 wherein when receiving a data recovery request with a target time between the
19 first point in time and the second point in time, the storage system selects one of the first
20 snapshot or the second snapshot based on the first information, the second information and the
21 target time, and selects at least one of the journal data ~~entries~~ corresponding to the write request
22 conducted between one of the first or second point in time associated with the selected snapshot
23 and the target time based on one of the first or ~~the~~ second information associated with the
24 selected snapshot, the time ordering information, and the target time to recover data of the
25 portion of the data volume at the target time by using the selected snapshot and the selected at
26 least one of journal data,

Appl. No. 10/608,391
Amtd. dated March 28, 2006
Reply to Office Action of January 6, 2006

PATENT

27 wherein the storage system releases at least one of the stored journal data to
28 prevent from overflowing the journal data.

1 42. (Previously presented): The storage system of claim 41, wherein the time
2 ordering information includes time information and/or sequence number.

1 43. (Previously presented): The storage system of claim 41, wherein the first
2 and second information include time information and/or sequence number.

1 44. (Previously presented): The storage system of claim 41, wherein the
2 plurality of journal data are stored in chronological order.

1 45. (Previously presented): The storage system of claim 41, wherein at least
2 one of the journal data are stored before storing the first and second snapshots.

3 46. (Previously presented): The storage system of claim 41, wherein the
4 selected snapshot is closest in time to the target time.

1 47. (Previously presented): The storage system of claim 41, wherein the
2 selected snapshot is prior in time to the target time.